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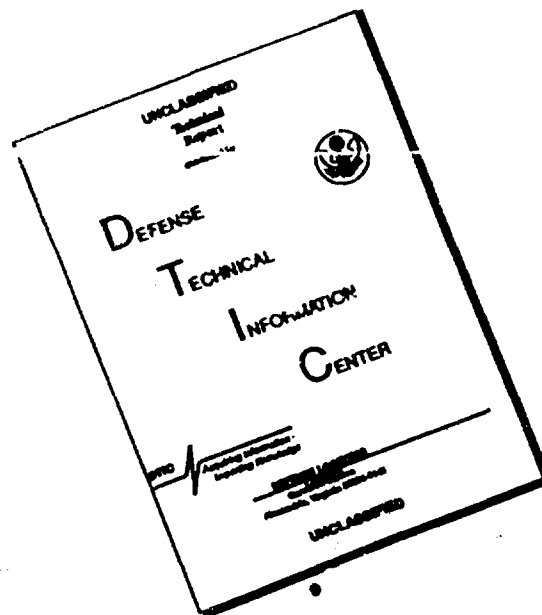
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BACTERIAL DISEASE OF LEAF SPOT IN KUANGTUNG PROVINCE

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PROBLEMS, TREATMENT, AND PREVENTION OF PADDY RICE
BACTERIAL DISEASE OF LEAF SPOT IN KUANGTUNG PROVINCE

Hua-nan Nung-yeh K'o-hsueh
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I. Condition of the Disease

The bacterial paddy rice disease of leaf spot is widespread in Kuangtung Province. Its occurrence in the suburbs of Canton, Chung-shan, Nan-hai, Fan-yu, Hsin-hui, Chu-hai, Tseng-ch'eng, San-shui, Hua-hsien, Ch'ing-yuan, Ch'ung-hua, and Hsingi has so far been reported. Of these hsien, in San-shui and Hua-hsien (according to the plant protection staff's speech at the symposium on 8 July) the disease has spread to all the areas of the respective hsien, but in other hsien only some areas are affected (one thousand to several thousand mou). The loss in yield of the affected paddies is generally 5-25%, but when the disease is serious, the loss may reach above 30%.

II. Problems in Treatment, Prevention

We began to study this disease in 1955, and in the process of investigation, we discovered that the major primary source of infection is the bacteria carrying seeds. The second source is the diseased oil weeds (*Leersia hexandra* Swartz) that grow along the edge of the paddies. The soil is not a carrier. When the bacteria carrying rice straw is allowed to decompose in the soil, the pathogenic bacteria are destroyed. (See a more detailed report of this study in Chih-ping Chih-shih /Plant Disease/ 1 (1): 6-8).

After we learned the primary source of infection, we began

a large area treatment and prevention program last year (1956) which was continued for three rice seasons until this year (1957) in the second farm of Hua-nan Institute of Agricultural Sciences (Ts'en-ts'un Farm), in the paddies where the disease had occurred continuously for several years. The prevention and treatment method was mainly the use of disease-free seeds from the "disease-free paddies" and the elimination of the oil weeds growing on the edges of the paddies (as matter of fact, all the weeds along the edges of the paddies were dug up.) In some paddies, the seeds from the "diseased paddies" were planted and the oil weeds were not thoroughly eliminated. When the disease occurred in the latter paddies, the rice plants in the center of the diseased area and the plants all around this center were cut down and burnt. Then, immediately, lime is used to spray the area once, and then once after every rain. After these methods were carried out, the disease did not occur in the early crop of 1956 in all of the 101 mou experimental paddies except the 2 mou from which oil weeds were either dug too late or not thoroughly dug out. In the control paddies (those of dies), the disease occurred at various times of the season. The experiment was continued for the late crop in more than 200 mou of rice paddies. Aside from the 174 mou in which seeds of the "diseased paddies" of the variety of Late Paichan 3 were used, the disease did not occur to any of the paddies. For the third season of the experiment, this year's early crop, aside from the 16.5 mou of Hsien-chan 305 (planted with bacteria carrying seeds), the 2.7 mou of Keng variety, 1 mou of Tung-yin 1, and the 26 mou of Kuang-ch'ang 13 which was located around the aforementioned paddies, the 174 mou remaining in Kuang-ch'ang 13 were free of the disease again (bacteria free seeds were planted.) Due to the fact that typhoon came to Kuangtung particularly early this year and more frequent than usual, the occurrence of the disease was early and more severe. In the past two to three years, the disease normally occurred in the later part of May or early part of June. This year, it appeared in the middle of May. The situation was especially serious in the first farm of Hua-nan Institute of Agricultural Sciences. It was even more serious than the rice blast disease. The loss of the paddies where the disease occurred reached above 30%. Under such a condition of epidemic proportions, the result of our experiment should be obviously reliable.

The result of the experiment was inspected on the 8th of July (the harvest began on the 10th of July) by the plant protection staff members of the more than 10 hsien's of Chung-shah, Nan-hai, Shun-te, Ch'ing-yuan, Hua-hsien, San-shui, and others, the leaders of the plant protection divisions, the seed division, the plant inspection stations, the scientists who were studying white leaf spot disease in Kiangsu and Anhwei, Chinese Academy of Agricultural Sciences, Hua-nan Institute of Agricultural Sciences.

and Hua-nan Agricultural College, and more than 30 rice specialists. Those who inspected the results and attended the symposium agreed that the result of this prevention and treatment method is very obvious, and the method should be recommended for widespread practice immediately.

In the practice of this method, the use of disease-free seeds and the elimination of the oil weeds on the edge of the paddies should be emphasized. Meanwhile, all rice straw that is to be plowed under should be completely decomposed before the new crop may be transplanted. In this manner, all the sources of the diseases may be completely eliminated. This is the only way to prevent this disease thoroughly. Due to the fact that this disease may spread with the wind and the rain, it should also be emphasized that the preventive practice should be carried out in all the paddies of an inclosure. If seeds from "diseased paddies" are used in some paddies, or if the oil weeds of a few paddies are not completely dug up and cleaned out, then, the disease will come back, and it will quickly spread to the other paddies.

Although if the diseased plants are dug up and lime is spread on the soil at the very onset of the disease, it is also possible to check the spreading of the disease and reduce loss, this method should not be relied upon, because: (1) it is difficult to cut out the diseased leaves cleanly to eliminate the source of the disease; (2) rain and wind are very frequent in Kuangtung; the lime spread on the soil may easily be washed off (or any drug for that matter;) much labor and material would thus be wasted; (3) at the onset of the disease, with a slight neglect of a few days (if there are wind and rain), the disease would have spread to a wide area; and reclamation would have been impossible; (4) overemphasis of the method of spreading lime may cause the people to neglect the use of seeds from "disease-free" paddies and the elimination of the oil weeds; some may think that there is enough time for treatment if the disease does occur.

III. Problem of the Research

1. Problem of Disinfecting Seeds

Due to the fact that this disease spreads mainly by the bacteria carrying seeds, while there is nothing in the appearance of the bacteria carrying seeds to distinguish them from the disease-free seeds, in the process of selecting good seeds, it is very easy to have diseased seeds mixed in the batch of seeds. Thus, disinfecting the seeds is a very important measure; however, we are not yet able to experiment with seed disinfecting. The result of the experiment shows that generally only 0.3-4% of the seeds

of the "diseased paddies" carry the bacteria, and in most cases, the rate is below 1%. If the seeds with such a low rate of disease occurrence are used for disinfecting experiment, the result is difficult to be accurate. We soaked the seeds in fluid suspension of the pathogenic bacteria, and used a vacuum pump to pump out the air once, in an attempt to drawing the air of the seeds out so that the bacteria may enter the seed coat, but we did not succeed at all. There may be many methods of examining the disease carrying rate of the seeds (or the bacteria carrying rate of the disinfected seeds), and it is not necessary to plant them to obtain the bacteria carrying rate; however, the bacteria carrying rate of the seeds must be rather high, before the result of the examination can be accurate, and the disinfecting experiment may bring obvious results. Continuous study in the future is needed to solve this problem.

It should be pointed out that at present, the careful selection of seeds from "disease-free paddies" or the exchange of seeds with the seeds produced from the "disease-free paddies" is still the most labor saving and most reliable method. If the production staff of the commune or county can recognize the disease and know for certain whether the disease has occurred in that particular commune or county, the problem of whether to use its own seeds or to exchange with other communities should be easy to solve. For such hsien's as San-shui and Hua-hsien, where the entire hsien is affected, if it is difficult to exchange seeds for the entire hsien, the area may be divided into districts, so that the seeds needed for each district are exchanged with seeds from "disease-free" paddies, and in two or three years, the program of seed exchange for the entire hsien may be accomplished.

2. Problem of Eliminating Oil Weeds

Since the oil weeds are the intermediary host of the pathogenic bacteria, the elimination of oil weeds in the area is a very important measure; however, the roots of the oil weeds reach several ts'un deep in the soil; it is difficult to pull them all out. We can only use the plow to cut off the stems and leaves on the ground surface, and the new branches and leaves will grow up in a few days. In our experiment, our purpose was to prove whether or not the use of seeds from disease-free paddies and the elimination of the oil weeds (in fact all the weeds) will cure the disease effectively; therefore, we weeded three times so as to be sure. Now, our experiment has been proved to be a success, the remaining problem is to determine how many weeding operations should be sufficient. Judging from the reality of production, three weeding operations are too many. This method will be especially difficult for areas with acute labor shortage problems. This is a problem urgently requires a solution.

Regularly, one to two years after healthy seeds have been used for an area and the oil weeds have been eliminated, if the disease no longer occurs in that period of time, the area may be considered as free of the disease. The practice of seed exchange and weeding will no longer be needed. A recent report from Japan indicates that the bacteria of rice leaf spot can overwinter in the root tissues of the oil weeds. If such is also the case of the bacteria of our leaf spot disease, then, the weeding operation may have to be continued after the first one to two years, and whether the disease may thus be completely eliminated is still a question.

3. Identification of the Pathogenic Bacteria

At first we isolated from the leaf spots of the paddy rice a strain of bacteria we called O type, which was straw yellow colored on the potato-cabbage culture medium. The fluid was thin. The strain of bacteria isolated from the oil cabbage is named the G type, which was fresh yellow colored with very thick fluid. The O type was repeatedly used to inoculate the oil weeds and the G type the paddy rice; the leaf spot disease occurred every time. Later both of these types were obtained from paddy rice as well as oil weeds. Judging from the morphology, the culture characteristics, and certain physiological and biochemical properties we tested, these two strains of bacteria are both undoubted members of the genus *Zanthomonas*. Aside from the fact that the G type is slightly more yellow, and the fluid is thicker, the two types (especially the O type) are not obviously different from the white leaf spot rice disease causative bacteria sent to us by Professor Fang Chung-ta (2455/0022/6671) from Nanking. Preliminary serum titration indicates that there is some difference among the three strains of bacteria, but the difference is not great. The three strains were used to inoculate separate paddy rice plants with mechanical rubbing method, and artificial wind and rain method (sprinkling water from the top and blowing a fan from the side), the leaf spot disease was produced in all cases. Of course, it is too early yet to reach a conclusion; however, the problem of whether or not the strip leaf spot disease of Kuangtung Province and the white leaf spot disease of Nanking are the same is a very interesting one. What is the relationship of the two diseases? Professor Fang Chung-ta and we are currently studying this problem. We hope to find an answer soon.

4. Is There Typical White Leaf Spot Disease in Kuangtung?

At present, we are also anxious to know whether or not white leaf spot disease of rice exists in Kuangtung (what is the typical white colored leaf spots.) In 1955, when we began to study the white leaf spot disease (at that time our aim was to study the

white leaf spot disease.) we isolated the specimens collected from various regions more than one thousand times and never obtained the pathogenic bacteria. We used microscopes to examine the spots many times, and no bacteria were observed. This year (1957) we gathered specimens and tested more than 600 times, and still no pathogenic bacteria were obtained. Under a microscope, there was no sign of appearance of bacteria from the vesicles. Thus, judging from the result of investigations of these three years, the white leaf spot disease has not occurred in the hsien of the Pearl River Delta. This problem, however, is in need of continuous study.